

DEPARTMENT OF FISH & GAME
STATE OF IDAHO
BOISE, IDAHO

THE EFFECTS OF WASCO WATER FEED KILLER ON RAINBOW TROUT

Object of Experiment

Due to the increasing use of various herbicides in the passed several years to destroy vegetation in irrigation canals and streams, a substantial loss of fish life has occurred. On July 25, 1952, a herbicide called "Wasco Water Weed Killer" was applied under approximately 150 pounds of pressure into the Portneuf River below the Chesterfield Reservoir. A large loss of fish was reported. As a direct result of the Portneuf River incident the following experiment was conducted to determine the concentration of herbicide required to kill trout. This information is considered pertinent to an intelligent estimate of the fish loss on the Portneuf River.

Characteristics of "Wasco Water Weed Killer"

Correspondence with Mr. A. Stark, chemist for the Wasatch Chemical Company which handles the herbicide failed to yield the chemical name or composition of the compound. However, the correspondence did yield the following information.

1. The material is an aromatic hydrocarbon with a distillation range between 250 and 500 degrees F. It must be injected into the water under high pressure to get proper emulsification.
2. The compound is 98% aromatic and 2% emulsifier. Its density is less than that of water.
3. The minimum concentration which has been found effective on submerged vegetation is 330 ppm.. However, the concentration used often exceeds 1000 ppm.. allowing the stream to carry the chemical a greater distance.
4. The present recommendation for application is 12 gallons per second feet and extending the interval between treatments to about 3 to 4 miles.

In the Portneuf River an estimated 666 ppm.. was distributed in the stream directly below the dam and an additional 185 ppm. approximately 3960 feet below the dam. During both applications the chemical was applied under pressure.

Experimental Method

On August 13, 1952 at 11:00 A.M. two aquariums were filled with 139,129 cc. of water and serators placed in each tank. After filling, the water temperature was 57°F. At 2:30 p.m. the water contained 7.1 ppm. of oxygen in each tank. 23 hours later the water temperature had increased to 68°F. One aquarium was used as a control and designated as Tank No. 1. In the tank were placed 3 rainbow trout 8 to 11 inches in length, 3 rainbow trout 4 to 6 inches in length, and 8 rainbow trout 2 to 3 inches in length. In the aquarium designated as Tank No. 2 were placed 2 rainbow trout 8 to 10 inches in length, 3 rainbow trout 4 to 6 inches in length, and 7 rainbow 2 to 3 inches in length.

In Tank No. 2.5 ppm. (0.695 cc.) of Wasco Water Weed Killer was added. One hour and twenty-six minutes later at 1:26 P.M. an additional 5 ppm.. were added. Seven hours later at 6:00 P.M. an additional 5 ppm.. was added, making

DEPARTMENT OF FISH & GAME
STATE OF IDAHO
BOISE, IDAHO

a total of 15 ppm.. of the herbicide in the tank at this time. Fourteen hours later at 8:40 A.M. after the concentration was increased the third time it was again increased 15 ppm.. making a total of 30 ppm.. in Tank No. 2.

22 hours after beginning the experiment on August 14, 1952 at 9:00 A.M. an additional aerated aquarium designated as Tank No. 3 was filled with 139,129 cc of water and 30 ppm.. of Wasco Water Weed Killer added. Into Tank No. 3 were placed approximately a 10 inch rainbow trout, a 5 inch rainbow trout, and two 3 inch rainbow trout. These fish were taken from Tank No. 1.

At 10:35 A.M. on August 14, 1952, a fourth aerated aquarium was filled with 139,129 cc of water and a concentration of 200 ppm.. of Wasco Water Weed Killer added to the aquarium. In this tank was placed a 10.5 inch rainbow trout taken again from the control tank.

The various concentrations of Wasco Water Weed Killer in each instance was placed in a small glass container containing water and vigorously shaken for 2 to 3 minutes prior to pouring the contents into the respective tanks. After pouring the solution in the tanks it was mixed thoroughly by stirring. Stirring continued at various intervals during the daylight hours. In Tank No. 2 which was left over night with 15 ppm.. concentration of the chemical, the tank was not stirred during the night.

Results and Observations

Tank No. 1. At no time during the course of the experiment did the fish in this tank show any sign of distress. All appeared in excellent condition And usually stayed at the bottom of the tank.

Tank No. 2. No definite distress could be noted in the fish at a concentration of 5 ppm. except the fish seemed to stay in the upper portion of the tank. 14 minutes after the concentration was raised to 10 ppm. the fish showed definite signs of distress. The fish were rising to the surface, loss of stability was evident, and the fish could be easily captured. The larger fish showed the first sign of distress, but by 24 minutes after the concentration was increased to 10 ppm., all fish seemed equally effected. Approximately 2 hours in the 10 ppm. concentration (3:30 P.M.) caused the fish to be swimming on their back. Consistent efforts were made by the fish to gulp air.

No change in the condition of the fish was noticed when they were observed at 5:00 P.M. By 6:00 P.M. the fish seemed to be recovering from the herbicide. The gulping for air had ceased and the fish were swimming in a conventional manner, although still at or near the surface. At this time the concentration was increased to 15 ppm.. The fish were again observed at 10:45 P.M. and were showing considerable distress. The usual symptoms of swimming on their backs or hanging in a vertical position with their heads out of water gulping air were prevalent. Fish again showed no resistance to capture. The larger fish seemed more distressed than the smaller ones.

The fish were next observed at 8:00 P.M. the following morning, August 14, 1952. One large rainbow trout (9inches) was found dead. The remaining fish

DEPARTMENT OF FISH & GAME
STATE OF IDAHO
BOISE, IDAHO

seemed largely recovered and showed little sign of distress. Difficulty was encountered in attempts to capture the fish. At 8:40 A.M. the concentration was increased to 30 ppm. and 25 minutes later at 9:00 A.M. the fish were in great distress. The symptoms being those described previously. Death eventually overtook all the fish in Tank No. 2 except two which were returned to the control tank prior to the death in order to determine if they would recover.

Time of death of the individual fish is as follows:

9:25 A.M.-----3 inch fish
9:55 A.M.-----2.5 inch fish
10:10 A.M.-----5 inch fish
10:13 A.M.-----4 inch fish
10:14 A.M.-----2 inch fish
10:15 A.M.-----3 inch fish
11:25 A.M.-----3.5 inch fish
11:25 A.M.-----6 inch fish
11:30 A.M.-----3 inch fish

The fish at death were unduly rigid. Loss of color in the gills of some fish was evident although the gills of others appeared normal.

Tank No. 3. As previously stated the fish were subjected to a 30 ppm. concentration of the chemical at 9:00 A.M. on August 14, 1952. For 5 to 7 minutes after the 30 ppm. was applied the fish seemed unaware of the presence of the herbicide. Shortly thereafter the usual symptoms appeared and the fish were in severe distress. The larger fish showed the earliest distress, but death occurred to the smaller fish in less time. The deaths occurred as follows:

9:50 A.M.-----2 inch fish
10:05 A.M.-----3 inch fish
11:29 A.M.-----10 inch fish
11:59 A.M.-----6 inch fish

Thus, in less than three hours all the fish present in Tank No. 3 had succumbed to the herbicide at a concentration of 30 ppm.. Stiffness at death was again very apparent.

Tank No. 4. The 10:5 inch rainbow trout showed immediate distress at the herbicide concentration of 200 ppm.. There occurred vigorous thrashing and jumping by the fish accompanied by gulping for air. Five minutes after the herbicide was applied the fish had lost its stability and swimming on its back. Eleven minutes later the fish succumbed. However, this fish was very limber and did not portray the stiffness which was prevalent in the fish which took several hours to die.

Deductions and Conclusions

It is reasonable to conclude that rainbow trout subjected to 30 ppm. of Wasco Water Weed Killer for 2 to 4 hours will succumb to this chemical. At higher concentrations the period of time required to cause death decreases proportionally. 200 ppm. will kill rainbow trout in 19 minutes. Apparently the chemical has little selective qualities in regards to different aged fish. While the larger fish showed the quickest signs of distress, the small fish died as quickly or sooner than the larger fish.

DEPARTMENT OF FISH & GAME
STATE OF IDAHO
BOISE, IDAHO

The effectiveness of the herbicide to cause mortality in fish could well be related to the degree of success attained in emulsifying the chemical with the water. It is felt that the recovery of the fish in Tank No. 2 during the night in a concentration of 15 ppm. may be attributed to the chemical coming out of a solution and remaining at the surface of the water. The standard method of applying the chemical under 100 to 200 pounds of pressure is much more effective in emulsifying the chemical with the water than the writer was able to obtain in the laboratory. Further the action of the stream would further tend to promote mixing—probably at a much better degree than was obtained in the experiment. It is strongly suspected that if an effective emulsification of the chemical with the water is obtained that less than 30 ppm. of this herbicide is sufficient to cause death in trout. The lack of time prevented further work on this matter.

The efforts of the dying fish to gulp air suggests asphyxiation is the cause of death. It is possible that the chemical coats the gills and prevents transfer of oxygen from the water to the blood stream. However, except for the fish which died in 19 minutes at 200 ppm., the fish were abnormally rigid when death occurred. This suggests that the herbicide may have a double effect. First, death by asphyxiation and secondly, an accumulative effect which when absorbed into the blood stream through either the gills or digestive system would result in damage to the nervous system. However, further work must be done before the actual cause of the death is known. Dr. professor of physiology at U.S.A.C. is at the present time working on the actual cause of death.